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How Ad Hoc is Phonology?
Evidence from Tocharian*

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1. Introduction

1.0. Background Assumptions.

Evidence exists which can be used to construct arguments against generative phonology as a correct theory of the phonologies of human languages. This evidence, from the language Tocharian B, is presented in section 1, along with the arguments that it provides. The validity of these arguments depends crucially on what one takes to be the goal of a linguistic theory; therefore, the view of this goal which has been assumed is stated explicitly here. Though most phonologists (and in fact, most linguists) probably share this view, justification is nonetheless provided for taking this particular view rather than others that might be taken.

The particular view of the goal of linguistic theory which is assumed here has been stated by, among others, Joseph (1980:345),[1] who states that "Among the primary concerns of theoretical linguists are the problems of characterizing what constitutes a 'possible' and conversely an 'impossible' human language." An assumption which is related to this view, seldom stated explicitly, but which most linguists seem to make ahead of time, is that the class of possible human languages is a proper subset of the class of conceivable languages. Put another way, it is assumed that there are some conceivable languages which are <u>not</u> possible human languages. Thus, the goal of linguistic theory might be viewed as separating the class of languages that are possible human languages from the class of languages that are not. There are resons for supposing that the class of human languages is considerably restricted, but even if this assumption turns out to be incorrect, it is more fruitful, until the question is definitely decided, to assume that there are restrictions than to assume that there are not. The former assumption is more fruitful because it has empirical consequences, whereas the latter does not, and it can be argued that such consequences make it possible to compare theories of language in a principled manner.

If the class of possible human languages is in fact restricted, a theory which correctly specified this class might involve two different kinds of conditions. On the one hand, the theory might specify some property that <u>every</u> human language <u>must</u> have, thus narrowing the class of possible human languages to only those that have this property. On the other hand, the theory might specify some property that <u>no</u> human languages <u>can</u> have, thus limiting the class of possible human languages to those that do not have this property. Of course, a theory could incorporate only one or the other of these two types of conditions, or a combination of both types. Whichever of these three possibilities is chosen, it can be demonstrated that the theory has empirical consequences;

that is, the theory is subject to support or disconfirmation by the facts of human languages. If the theory claims that all languages will have a certain property, then an example of a language without the property falsifies the claim. Similarly, if the theory claims that some feature will be absent from all human languages, then an example of a language that possesses that property falsifies the claim. Of course, a theory which incorporated both types of restrictions would be subject to empirical disconfirmation of either sort. In contrast to theories that attempt to restrict the class of possible human languages, theories that do not attempt to do so have no empirical consequences, because they make no predictions about the properties of human languages as a class; thus, no matter what is found to be true with reference to the facts of human languages, these facts will have no relevance to an evaluation of the theory.

It can be seen then, that a linguistic theory which restricts the class of possible human languages is testable, whereas one that does not restrict this class is not testable. Clearly, then, it is desirable to assume that the class of possible human languages is in fact restricted, and to construct only theories which make claims about what these restrictions are. Since the correctness of theories which are constructed in this way can be evaluated by referring to the facts of human languages, it becomes possible to compare any two or more such theories. If there are no counterexamples to any of the theories which are being compared, then the theory which places the greatest restrictions on the class of human languages is to be preferred. The most restrictive theory is to be preferred, because it is the theory most likely to be <u>too</u> restrictive; that is, it would be the theory most likely to <u>incorrectly</u> require the inclusion or exclusion of some property for all human languages. Such a theory would be the most readily falsifiable one, for example, by the discovery of some language that does not meet with the predictions of the theory. Therefore, if none of the competing theories has suffered any counterexamples, then the most restrictive theory is the most likely to be correct.

Though many phonologists hold the same basic view of linguistic theory as the one which is stated above, it is still important to be explicit about these matters, because in practice, few phonologists are. Quite often, phonologists have even failed to consider their proposals in light of the requirements that linguistic theories must meet in order to be falsifiable, yet most of these same phonologists would probably accept these requirements as desirable, because they do wish to be able to evaluate phonological theories empirically. As a result of failing to consider fully enough questions of falsifiability, generative phonologists have come to be in the strange position of holding a phonological theory which is inconsistent with their views of linguistic theory as a whole. In the next chapter, the ways in which generative phonology is inconsistent with the goal of linguistic theory is demonstrated. First, though, the data on which this demonstration is based is presented and analyzed.

2. Generative Phonology in Light of the Goal of Linguistic Theory.

2.0. Principles of Generative Phonology.

In order to demonstrate that generative phonology is inconsistent with the goal of linguistic theory, it is first necessary to state the important principles of this phonological theory. There are a number of different versions of the theory of generative phonology, which differ on varying points, but which at the same time are all alike in certain basic ways. The points on which these versions differ do not have the same theoretical status as the points on which they agree. To differentiate the status of the two, a distinction is employed here, which is discussed by Zwicky (1972:151), between methodological principle and theoretical or substantive principle. Zwicky says that "substantive principles are theoretical requirements, methodological principles are theoretical biases." To apply this distinction, it would be said that the substantive principles of generative phonology are those principles which a theory must subsume in order for that theory to be a version of a generative phonological theory. If the theory omits or alters any of the substantive principles of generative phonology, then it is not a version of a generative phonological theory, but rather, it is a version of some different theory of phonology. On the other hand, different versions of generative phonology may vary freely on methodological principles, and still remain instances of the same general theory of phonology.

The single theoretical requirement, or substantive principle, of generative phonology can be stated as follows (together with references to phonologists who have stated this principle in some form):

(1) The phonological component of a grammar maps input strings from the syntactic component onto systematic phonetic strings. The phonological component accomplishes this mapping by applying phonological rules, which utilize a set of phonological features, boundaries, and other pieces of notation which the theory provides (e.g., parentheses, angled brackets, etc.), and which may mention morphological or morphosyntactic information (cf. Householder 1979:253; Anderson 1979:3; Chomsky and Halle 1968:9-12, 14, 295-298).

In addition to this substantive principle, three methodological principles which are commonly employed by generative analysts can be given as follows:

(2) Other things being equal, phonological rules which mention only phonological features, boundaries, and notation are to be preferred to rules that mention some nonphonologically defined class of lexical items (cf. Zwicky 1972:156).

(3) Other things being equal, every morpheme in a language should have a unique underlying shape; that is, ceteris paribus, there is one and only one representation of a given morpheme in the lexicon, and only a single shape of any given morpheme is the input to the phonological component. Suppletion or listing of the allomorphs of a given morpheme in the lexicon is to be resorted to only when no acceptable phonological account

is available (cf. Householder 1979:253; Zwicky 1972:156; Kenstowicz and Kisseberth 1979:46-57).

(4) "Other things being equal, an occurrence of a segment not involved in alternations should be represented underlyingly in its surface form" (stated by Zwicky 1972:158).[2]

In the next section, evidence is presented which can be used to argue that principle (1) above cannot be maintained. Specifically, it is argued in a later section that a major part of the mapping of lexical representations onto phonetic representations should not be accomplished by "phonological" rules, that is, by rules that mention phonological features and other phonetic information, but rather, by a set of morphological rules. It is further argued that the class of rules which should be allowed to mention phonological features must be very narrowly specified, and that therefore, the class of rules which are actually phonological is much smaller than the class of such rules which is allowed by generative theory.

Arguments can also be presented against the methodological principles given above. In particular, it can be argued that the strongest form of any of the three principles that can be defended allows ad hoc analyses of linguistic data. In general, it is argued that the set of four principles which are given above cannot be interpreted in a way which places any nontrivial restrictions on the class of possible human languages. Before this claim can be defended, the evidence on which it is based must be presented.

2.1. A Generative Analysis of the Tocharian Data.

In this section, a generative phonological analysis of data from the language Tocharian B is presented. Tocharian B (or West Tocharian) and Tocharian A (or East Tocharian) are the two languages which constitute the Tocharian branch of the Indo-European family of languages. The data from Tocharian B is the evidence upon which the arguments in this work are based. Before a generative analysis of this data is undertaken, however, the phonetic inventory of Tocharian B is given below, and several points are made concerning stress.

2.1.1. The Sounds of Tocharian B.

Krause and Thomas (1960:39) give the following inventory of sounds for Tocharian B:[3]

CONSONANTS

	Stops (all voiceless)		Nasals		Liquids		Sibilants (all voiceless)	Glides
		palatalized		palatalized		palatalized		
Bilabial	p	py	m	my				w
Dental	t		n		l,r	ly	s	
Alveopalatal							s^{4}	
Palatal	c		ñ				ś	y
Velar	k	ky	ṅ					

VOWELS

	Front		Central	Back	
	Long	Short		Long	Short
High	ī	i	ä	ū	u
Mid		e	a		o
Low			ā		

Tocharian B also has three diphthongs, āu, au, and oy, and nasalized vowels, which are represented by the symbol ṃ following the vowel (i.e. Vṃ = [Ṽ]). The interpretation of the consonants which is given here, as well as the interpretation of the front vowels and the back vowels, is standard, and requires no further comment. The interpretation of the central vowels, however, is more difficult to be certain about, and the interpretation given here follows that of Jasanoff (1978:30-31). Jasanoff proposes the following phonetic values for the central vowels:

ä = [ɨ]

a = [ʌ]

ā = [a]

Jasanoff gives two different arguments in favor of this interpretation. First, Jasanoff observes, the vowel ä is best interpreted as a phonetically high vowel, because it often fluctuates with the other two high vowels, i and u, in the spelling of certain words. Specifically, ä is sometimes spelled as i in the environment of labial and palatal consonants. For example, cäñcare 'lovely'[5] is sometimes ciñcare (Jasanoff 1978:30. Cf. Krause and Thomas 1960:49 for the further example of śänmalñe 'das Kommen', sometimes spelled as śinmalñe). In addition, ä is sometimes spelled as u in the environment of velar or labiovelar consonants (Jasanoff 1978:30). For example, kwälypelle, gerundive of the verb kulyp- 'desire', is sometimes spelled as kulypelle (Cf. Krause and Thomas 1960:50 for the further example of kwärsarwa, plural of 'Vehikel, Meile,' sometimes spelled as kursarwa[6]). Thus, since ä seems to be phonetically high, yet clearly distinct from the front vowel i and the back vowel u (since it is usually differentiated from them), it seems correct to interpret it as a high central vowel.

Second, Jasanoff argues, once ä has been established as a high central vowel, it seems best to interpret a and ā as central vowels also, because this interpretation allows a particular alternation in which these three vowels are involved to be viewed in a highly natural way. Specifically, ä alternates with a, and a alternates with ā, the first vowel in each pair appearing unstressed, and the second vowel appearing under stress. For example (Krause and Thomas 1960:43) tárkär "Wolke,' but plural tärkärwa; párna 'draussen', but related adjective, pärnáññe 'aussenstehend'; śársa 'wusste', but 3rd person plural śärsāre; tāka 'wurde', 3rd person plural takāre. Jasanoff argues that if the three vowels involved in these alternations are interpreted as central vowels of three heights, with ä the highest and ā the lowest, then the alternation of ä with a and a with ā can be interpreted as the lowering of ä (= [ɨ]) and a (= [ʌ]) under stress, which is a very natural phonological phenomenon. Jasanoff's interpretation is accepted here, though it should be noted that whether this interpretation is actually correct or not, the arguments presented in this thesis are in no way affected.

2.1.2. Stress.

Krause and Thomas (1960:43) give the following rule for stress in Tocharian B:

> "Die Hauptregel lautet: In den meisten zweisilbigen Wörtern ruht der Akzent auf der ersten, in drei- (und teilweise vier) silbigen auf der zweiten Silbe."

Krause and Thomas do note that there are exceptions to this rule; therefore, wherever exceptions to this rule occur in the data given below, they are specifically noted. Otherwise, all forms can be assumed to follow this rule.[7]

2.1.3. The Analysis.

Before a generative analysis of the Tocharian data is given, several points should be made. It can be argued that it is desirable to assume the strongest forms of principles 2, 3, and 4 of generative phonology given above (pp. 58-59), until some reason can be found, based on the data, to weaken the strongest forms of these three principles. That is, it would be most desirable to be able to claim that phonological rules never mention any information other than phonological information (the strongest form of principle 2), and that every morpheme in a language (other than, of course, clear cases of suppletion) always has exactly one underlying representation (the strongest form of principle 3), and that any surface segment not involved in alternations is always represented underlyingly in its surface form (the strongest form of princple 4). It is most desirable to be able to claim the strongest form of each of these principles, because the strongest form places the greatest restriction on the class of possible human languages, and thus most effectively pursues the goal of linguistic theory. It might turn out that the strongest form of a given principle is inconsistent in some way with the facts of human languages; however, if that is the case, the principle should be weakened only as much as is necessary to make it consistent with the known facts, in order for the weakened form of the principle to still place the greatest possible restriction on the class of possible human languages. Moreover, it might even turn out that a given principle must be weakened so much that it no longer places any nontrivial restrictions on this class; in such a case, the principle must be abandoned. As the following generative analysis is carried out, then, one of the major questions to be answered is the degree to which principles 2, 3, and 4 must be weakened to make them consistent with the data, if in fact they must be weakened at all. This issue could be seen as equivalent to specifying the exact meaning of the condition other things being equal in each of these three principles as stated in section 2.0; that is, if the strongest forms of these principles do not hold unequivocally, then the exact conditions under which they fail to hold must be specified.

A second important point concerning the analysis should be made. This analysis is not simply one of a number of possible generative analyses of this data; rather, it can be claimed to be the best account that it is possible to provide for this data within a generative framework. Arguments to support such a claim are given in the course of analyzing the data, as well as in the remainder of this chapter.

In answer to a possible objection to the methodology that is used, one final point deserves attention. Several verbal paradigms are examined in succession, one at a time, in order to construct the details of the generative account. It might be thought that the order in which the paradigms are presented determines the particular details of the account, and that if they were examined in a different order, a different account would result. This objection is not valid, however, because at each point in the analysis, all of the viable alternative analyses are considered, so that no possibility is omitted simply because of the order in which the data is presented. Therefore, the order in which the data is presented is based entirely on considerations of clarity and ease of presentation, and has no affect whatever on the resulting analysis.

The analysis begins with the active paradigm of the verb pälk-[8] 'leuchten' (Krause and Thomas 1960:262):

Singular	1	palkau	Plural	1	pälkem[9]
	2	palkät		2	palkcer
	3	palkäṃ		3	palkeṃ

First, it should be noted that the 1st person plural form is stressed on the second syllable; thus, given the alternation between ä and a, which is conditioned by stress (discussed above, p. 6), the stress in this form accounts for the appearance of ä in the first syllable, since it is unstressed, in contrast to the appearance of a in the first syllable of all the other forms, where the vowel is stressed. There is no way to determine at this point which of the two vowels involved in the alternation is underlying, but for the moment ä can arbitrarily be taken as the underlying vowel. Forms which can be used to decide this question definitely appear later in the data.

Second, the source of the nasalized vowels in the 3rd person of both numbers can be determined, and it can be shown that these vowels are derived, not underlying; therefore, a discussion of this matter simplifies the remainder of the analysis of these forms. All nasals but n and ṅ occur word finally on the surface in Tocharian B, and ṅ occurs on the surface only before velar stops. Thus, given these distributional restrictions, final nasalized vowels can be derived from an underlying sequence of a vowel followed by n; that is,:[10]

A) $$V \; C \longrightarrow V \; \emptyset \; / \; \_\_\# \qquad \begin{bmatrix} +\text{nasal} \\ +\text{anterior} \\ +\text{coronal} \end{bmatrix} \qquad [+\text{nasal}]$$

Now the forms must be divided into component morphemes. The first four segments of each form (other than the alternation between ä and a, which has already been accounted for) are invariant, so at least this much can be taken to be part of the underlying verb stem.

It is possible, then, that the underlying verb stem is simply /pälk/. Other viable possibilities are /pälkä/ or /pälke/. If the verb stem is taken to end in ä or e underlyingly however, several facts about the surface forms are difficult to account for. Specifically, ä of the 3rd person singular and e of the 3rd person plural appear in exactly analogous phonetic contexts; thus, there is no straightforward way to take one of these vowels as the final vowel of the underlying verb stem and to derive the other one by phonological rule. Further, if the underlying verb stem is taken to end in a vowel, the fact that no vowel surfaces in the 2nd person plural form would have to be explained. Therefore, tentatively, it seems best to take /pälk/ as the underlying verbal stem, and the following as the underlying representations of the active verbal endings:

Singular	1	/au/	Plural	1	/em/
	2	/ät/		2	/cer/
	3	/än/		3	/en/

Next, the deponent-passive paradigms of two different verbs, mäsk- 'sich befinden, sein,' and plānt- 'vernügt sein,' may be considered:

Singular	1	mäskemar	Plural	1	mäskemt(t)är
	2	mäsketar		2	mäsketär
	3	mäsketär		3	mäskentär
Singular	1	plontomar	Plural	1	plontomt(t)är
	2	plontotar		2	plontotär
	3	plontotär		3	plontontär

In order to have a single underlying representation for the stem of each of these two verbs, along with a single underlying representation for each of the deponent-passive endings, the following representations are required:

STEMS

/mäske/ /plonto/

ENDINGS

Singular	1	/mar/	Plural	1	/mt(t)är/
	2	/tar/		2	/tär/
	3	/tär/		3	/ntär/

The above solution is the best one, because if the e in the mäsk- forms and the second o in the plānt- forms were analyzed as part of the endings, each and every deponent-passive ending would exhibit two different surface allomorphs, for example, lst person singular -emar and -omar,

2nd person singular -etar and -otar, etc. Further, the distribution of these allomorphs could not be predicted on phonological grounds, so it would not be possible to have one as underlying and to derive the other by phonological rule. Thus, each of the deponent-passive verbal endings would have two underlying representations, and this solution would thus violate the strong form of principle 3, and therefore ought to be avoided if possible. This solution and its undesirable consequences can be avoided by analyzing the e and the o vowels as part of the verbal stem, which also means tentatively accepting the underlying representations given above as the correct ones for the deponent-passive verbal endings.

To return to the question of which vowel underlies the alternation between ä and a, the deponent-passive verbal endings above provide evidence thatbears on this question. If the strong form of principle 4 (p. 59 above) is adopted, as it is argued above that it should be, then the surface forms of the deponent-passive endings lead to a determination of the underlying vowel in the a ~ ä alternation, as well as in the ā ~ a alternation (both discussed above, p. 61). The vowels a and ä both occur in the surface forms of the deponent-passive endings, for example, in the 2nd person singular -tar and the 3rd person singular -tär. These endings always constitute the last syllable in a word of at least two syllables; therefore, it follows from the main stress rule (given above, p. 62) that the vowels in these endings are never stressed. Thus, the a of the 2nd person singular deponent-passive ending does not alternate with a, because the vowel is always unstressed in this ending. Similarly, the ä of the 3rd person singular deponent-passive ending is always unstressed, and therefore, this ä does not alternate with a. Therefore, the underlying representation of every a in the deponent-passive endings should be /a/, by the strong form of principle 4, because these segments never alternate. By the same reasoning, every ä in these endings should be represented as underlying /ä/.

Moreover, it can be argued that, if a and ä are taken as the underlying vowels in these cases, where the vowels do not alternate with ā and a respectively, then a and ä must be chosen as the underlying vowels for the alternating cases as well. To demonstrate this, let the alternative solution be adopted; that is, let it be supposed that the vowel underlying the nonalternating a in -tar is /a/, and that the vowel underlying the nonalternating a in -tar is /a/, and that the vowel underlying the nonalternating ā in -tär is /ä/, but that the vowel underlying alternating ä, as in pälk- (p. 63 above) is /a/, and that the vowel underlying a ~ ā is /ā/. Let it also be noted that no ā occurs unstressed on the surface, and that no ä occurs stressed on the surface.

If the alternative solution proposed here is adopted, then the only place that ä would occur in underlying representations in Tocharian B would be in the final syllables of endings, which is an unnaturally limited distribution for any segment. The reason that the distribution would be so limited is that the final syllables of endings are the only syllables where the a ~ ä alternation (and the ā ~ a alternation) never

occurs. Therefore, if this unnaturally limited distribution of ä in underlying representations is to be avoided, then ä must be taken as the underlying vowel both for surface ä that does not alternate, and for surface alternating a ~ ä. In this solution, the occurrence of underlying ä is entirely unrestricted; that is, the vowel may occur underlyingly in any position.

A similar argument can be made for the ā ~ a case. If nonalternating a is derived from underlying /a/, but a alternating with ā is derived from underlying /ā/, then the occurrence of ā in underlying representations is restricted to syllables other than the final syllables of endings, but again, this restriction is a strange one.[11] If, on the other hand, /a/ is taken as the underlying representation not only for nonalternating surface a, but also for surface alternating ā ~ a, then the occurrence of /a/ in underlying representations is entirely unrestricted. Therefore, the underlying representation for surface a ~ ä is /ä/, and the underlying representation for surface ā ~ a is /a/, and the rule that governs these two alternations can be stated as follows:

B) $$V \longrightarrow \begin{bmatrix} -\alpha\text{low} \\ \text{<-high>} \end{bmatrix} \; / \; \underline{\quad} \; [+\text{stress}]$$

$$V = \begin{bmatrix} -\text{front} \\ -\text{back} \\ -\text{low} \\ \alpha\text{high} \\ \text{<+high>} \end{bmatrix}$$

2.1.3.1. The Present Palatalizing Verbs.

Certain verbal paradigms in Tocharian B exhibit several interesting alternations, and necessitate a number of revisions to the previous analysis. As a first example of these verbs, the deponent-passive paradigm of the verb klyaus- 'hören' may be examined:

Singular	1	klyausemar	Plural	1	klyausemt(t)är
	2	klyauṣtar		2	klyauṣtär
	3	klyauṣtär		3	klyausentär

This verb is similar in some respects to the verb mäsk- (p. 64 above), but in two respects it is different. First, the vowel -e- is present in the 1st person singular, and 1st and 3rd persons plural, but is absent in the other persons, whereas in the verb mäsk- the -e- vowel is present in all persons. Second, s appears in the stem in the persons with the -e- vowel, but alternates with ṣ which appears in the forms without a following e. These two alternations, e ~ Ø and s ~ ṣ, must be accounted for. There are two possibilities for accounting for the e ~ Ø alternation; namely, either the vowel is present underlyingly and is deleted in some cases, or it is not present underlyingly, and is inserted in some cases. Considering the deletion alternative first, this possibility may be ruled out based on verbs like trik-[12] 'in die Irre gehen,' which shows 2nd person singular triketar, 3rd person singular triketär, and 2nd person plural triketär (Krause 1952:66; cf. Krause and Thomas 1960:200). If klyauṣtar, for example, were underlyingly /klyauṣetar/, with a vowel,

and the vowel were deleted by a phonological rule, then the rule would be expected to delete the -e- in triketar also, but the e in this form is not deleted, but surfaces. There is a way that a rule could be written which would delete the e in the klyaus- forms but not in the corresponding trik- forms; specifically, in the klyaus- forms where e is deleted, it is preceded by a continuant, but in the corresponding trik- forms, the e is not preceded by a continuant. Thus, a rule can be written that deletes e when preceded by a continuant and followed by a non-nasal (in order to keep the e in the other forms of klyaus- from being deleted):

$$C)\quad V \longrightarrow \emptyset \;/\; [+\text{continuant}] \_\_ [-\text{nasal}]$$
$$\begin{bmatrix} -\text{back} \\ +\text{front} \\ -\text{high} \end{bmatrix}$$

This rule correctly deletes the e in the 2nd person singular /klyauṣetar/, 3rd person /klyauṣetär/, and 2nd person plural /klyauṣetär/, but also correctly fails to delete the e in the 2nd person singular /triketar/, 3rd person singular /triketär/, and 2nd person plural /triketär/. However, this rule also incorrectly fails to delete the e in certain cases. For example, the verb kraup- 'anhäufen' (Krause 1952:63; Krause and Thomas 1960:188), exhibits the same distribution of e ~ ∅ as klyaus-, yet kraup- ends in a [-continuant]. In other words, if the underlying representation of the 3rd person singular klayauṣtär is taken to be /klauṣetär/, with an e, then the underlying representation of krauptär must be taken to be /kraupetär/, with an e also. Rule C deletes the e of /klyauṣetär/ to derive klyauṣtär, but fails to delete the e of /kraupetär/ and incorrectly derives kraupetär. The correct surface form of the 3rd person singular of kraup- is krauptär, without e. Therefore, the loss of the vowel in the klyaus- forms clearly has nothing to do with the fact that the vowel follows a [+continuant] in these cases, because there are also cases where the vowel is lost following a [-continuant]. Moreover, other than the difference between a preceding [-continuant] versus a preceding [+continuant], the klyaus- forms and the trik- forms are phonologically undifferentiable, yet in the klyaus- forms, there is an alternation between e and ∅, but in the trik- forms, there is not.

The first serious challenge to the strong forms of principle 3 has now been encountered, for Tocharian B possesses two different classes of verbs, one of which exhibits surface allomorphy (verbs like klyaus-), and one of which does not (verbs like mäsk- and trik-). Thus, it appears that the surface allomorphs of klyaus-, namely, klyause- and klyauṣ-, must simply be listed, for there appears to be no way to distribute them phonologically. However, though the deletion analysis does not work, the insertion alternative has not yet been examined, and perhaps this alternative provides a way out of abandoning the strong form of principle 3. Unfortunately, the insertion analysis does not work either, and this fact can be demonstrated readily. If an insertion analysis were proposed, the underlying representation of the 1st person singular of klyaus- would be /klyausmar/, and the application of the rule would correctly derive klyausemar. However, a verb like kaläk- 'folgen,' is of the same type as pälk- (p. 63 above), and thus, has a consonant final stem, to which endings are added, as has been demonstrated for pälk- above. The first person singular

deponent-passive of kalāk-, however, is kolokmar, without e. If Tocharian B had an insertion rule which derived klyausemar from /klyausmar/, then it would be expected to apply to an underlying form like /kolokmar/ as well, yet no such insertion rule applies, because /kolokmar/ surfaces as kolokmar. Thus, neither an e deletion nor an e insertion analysis works for the forms of verbs like klyaus-, and the strongest form of principle 3 must be modified. This question is taken up again later in this section, but now, the alternation between s and ṣ must still be accounted for.

Since ṣ occurs only before t, and s never occurs before t in the klyaus- forms, it might be hypothesized that it is this factor which causes the alternation, and that s becomes ṣ preceding t. Though such a rule would work for the klyaus- paradigm, it does not work for other paradigms that exhibit alternations very similar to those in klyaus-, for example, the active paradigm of āk- 'führen':

Singular	1	ākau	Plural	1	akem[14]
	2	āśt[13]		2	āścer
	3	āśäṃ		3	ākeṃ

It can be seen that āk- shows an alternation between k and ś in exactly the same persons that klyaus- shows an alternation between s and ṣ. Therefore, unless some way can be found to predict the distribution of s and k as opposed to the palatal alternates ṣ and ś, phonologically, then the allomorphs of all of these verbs must be listed in the lexicon.

Returning to klyaus-, it might be hypothesized that the forms with the ṣ alternate really do have a vowel that follows the stem in underlying representation, which palatalizes the s and then is deleted. It has already been shown above that this vowel cannot be identical in underlying representation to the vowel that surfaces as e in the nonpalatalized forms of a verb like klyaus-, and in all of the forms of a verb like mäsk-, but perhaps there is a palatal vowel in the underlying representation in the ṣ forms of klyaus- which is different from the underlying vowel in the forms of the verb that do not palatalize. If such a solution can be made to work, then the distribution of the palatal and nonpalatal consonants in a verb like klyaus- does not have to be stated in nonphonological terms, but instead can be predicted by rule.

The first step in such a solution is to determine what the underlying vowel in the palatal forms is. A very natural hypothesis is i or I, since either of these vowels could quite naturally condition a palatalization of the type found in klyaus-, and since it would also be quite natural for a high vowel to be lost in a medial unstressed syllable. Considering the possibility of i first, it can be seen that this vowel clearly conditions palatalization of just the sort found in klyaus- (and also in āk-), for example, roś̄icer, second person plural imperfect of rok- 'leuchten' (Krause 1952:104). However, this same form also demonstrates that i cannot be the underlying vowel that is being deleted in the palatalizing verbs, because here i is retained in a medial syllable; in aś̄cer, second person plural of ak- above,

on the other hand, it would have to be claimed that the i was deleted if an analysis with an underlying i in the palatal forms of the verb is to be defended.

Turning to the possibility of an underlying ï that palatalizes and is then deleted, problems exactly analogous to those with i arise. The 3rd person singular and 2nd person plural imperfect of täs- 'setzen' is taṣïtär (Krause 1952:105), again with ï showing palatalizing effects, but also being retained, where it should be deleted, if ï is to be defended as the underlying vowel in the palatal forms of verbs like klyaus-. taṣïtär compared directly with klyauṣtär shows that ï cannot be the underlying vowel in the palatalized forms of klyaus-.[15]

Another vowel that might naturally be thought to palatalize consonants is ä, but this possibility can be eliminated straightforwardly, since there are many examples of ä not causing palatalization, for example, nesäm, 3rd person singular active of nes- 'sein' (Krause 1952:61), in addition to the 3rd person singular active of pälk-, palkäm, given above.

The only palatal vowel left in the surface inventory of Tocharian B is e, but it has already been shown above that this vowel cannot be underlying in the palatalized forms of klyaus- because there is no phonological way to explain why the vowel would be retained in the nonpalatalized forms, but deleted in the palatalized forms. Further, if it is claimed that an underlying e in the palatal forms of the verb conditions palatalization, then it should condition palatalization in all of the forms. In other words, if the underlying representations of the forms of klyaus- all have an /e/, then the surface e in the 1st person singular and in the 1st and 3rd persons plural acts as though it were not an /e/, but the surface Ø in the other persons behaves as though it were an /e/, because it is associated with palatalization. Thus, if there were a vowel underlyingly in all six forms, it could not be the same vowel in every form. This problem is not new, however, for it has already been shown above that there is no way to have a single underlying representation for verbs like klyaus-. However, it can be seen that, although these verbs cannot have a single underlying representation, the palatalization in certain forms of the verb could be predicted phonologically if the palatalized forms had an underlying palatal vowel, and the nonpalatal forms had an underlying nonpalatal vowel; thus, surface e must be derived from a nonpalatal vowel, and surface Ø from an underlying palatal vowel. It has been demonstrated above that e is the most likely of the Tocharian palatal vowels to be underlying in the forms of the verb that have palatalized consonants. Using this vowel as underlying in these forms of the verb requires that surface e be derived from something other than underlying /e/, but this fact fits perfectly with the independent observation that surface e does not act like a palatal vowel.

If the palatal forms of verbs like klyaus- are underlyingly /klyause-/, it remains to be determined what the underlying representation is of the forms that do not have paltalization of the surface. In other words, the exact vowel that underlies surface e in the 1st person singular and 1st and 3rd persons plural must be determined. First, it can be seen that surface e in these cases cannot be derived from underlying i or ï, because these vowels always cause palatalization of a preceding

consonant (if the consonant has a platalized form), and surface e clearly does not condition palatalization. Second, it would not be possible to derive surface e from any of the vowels involved in the a ~ ä or ä ~ a alternations, because it would not be possible to predict, for example, if /ä/ were chosen as the underlying representation of e, which instances of underlying /ä/ would surface as ä, which as a, and which as e. In other words, not all occurrences of underlying /ä/ could be converted to e, because some of them must surface as ä, and some others as a, and there is no phonological way to predict when /ä/ is converted to e, and when it is not.

The next closest vowel to e in terms of features is o, and since o is not involved in any surface alternations, it would be possible to simply convert all occurrences of underlying o into e. However, it can be seen that it is not necessary to convert every underlying /o/, including those that do not figure in any alternations, into surface e, but only those which appear in nonpalatalizating forms of the palatal verbs. In other words, most occurrences of surface e can be derived from underlying /e/, since they are not involved in any alternations, and most occurrences of surface o can be derived from underlying o, since they are not involved in alternations. Only occurrences of surface e that act as though they were underlyingly nonpalatal need to be derived from underlying /o/. By converting only those occurrences of underlying /o/ that appear in palatalizing verbs into surface e, one can account for the alternations in these verbs, and the strongest form of principle 4 can still be maintained. The underlying /e/ vowels that must cause palatalization and then be deleted, as well as the underlying /o/ vowels that must be converted to surface e, always occur at the end of a verbal stem, and therefore, always before a morpheme boundary. Thus, the rules that are required convert /e/ to Ø and /o/ to e preceding a morpheme boundary. All occurrences of /e/ and /o/ not preceding a morpheme boundary are immune to the rules, and surface as e and o, respectively. One other rule, however, must be mentioned. Specifically, if the palatalization rule is used to account not only for the palatal alternations in verbs like klyauş-, but also in verbs like äk-, then the underlying representations for these two verbs are as follows:

Singular	1	/klyauso+mar/	Plural	1	/klyauso+mt(t)är/
	2	/klyause+tar/		2	/klyause+tär/
	3	/klyause+tär/		3	/klyauso+ntär/
Singular	1	/ako+au/	Plural	1	/ako+emo/
	2	/ake+t/		2	/ake+cer/
	3	/ake+än/		3	/ako+en/

It can be seen that in the 1st person singular, 1st person plural, and 3rd person plural of äk-, the stem vowel, o, precedes an e vowel which occurs initially in the ending, but there is no trace of the stem vowel in the surface forms. Thus, a rule is needed to delete a vowel before another vowel, and further, this deletion rule must apply before stress is assigned, because the stress pattern of the surface forms indicates that the underlying vowel at the end of the stem does not count as a

syllable when stress is assigned, so the vowel must be deleted before stress assignment. The rules that are required for the derivation of the forms of klyaus- and āk- are as follows:

D) $$\left\{ \begin{array}{l} \left[\begin{array}{l} \text{-vocalic} \\ \text{+back} \end{array} \right] \longrightarrow \left[\begin{array}{l} \text{-back} \\ \text{+continuant} \end{array} \right] \\ \left[\begin{array}{l} \text{+anterior} \\ \text{+continuant} \end{array} \right] \longrightarrow \left[\begin{array}{l} \text{-anterior} \\ \text{+high} \end{array} \right] \end{array} \right\} / \underline{\quad} \left[\begin{array}{l} \text{V} \\ \text{+front} \\ \text{-high} \\ \text{-low} \end{array} \right]$$

E) $$\left[\begin{array}{l} \text{V} \\ \text{+front} \\ \text{-high} \\ \text{-low} \end{array} \right] \longrightarrow \emptyset \; / \; \underline{\quad} \; +$$

F) $$\left[\begin{array}{l} \text{V} \\ \text{+back} \\ \text{-high} \\ \text{-low} \end{array} \right] \longrightarrow [\text{+front}] \; / \; \underline{\quad} \; +$$

G) $$\text{V} \longrightarrow \emptyset \; / \; \underline{\quad} \; \text{V}$$

The palatalization rule, D, must precede the deletion of e, which is accomplished by rule E, and which must precede rule F, because if F were alowed to precede E, it would feed it; that is, the underlying /o/ vowels which F converts to e would be deleted if E were ordered after F, but these derived e vowels actually surface, which demonstrates that F must counterfeed E (must be ordered after it). There are two restrictions on rule G. First, it must be ordered after D; otherwise, G would delete /e/ in the 3rd person singular of āk- before the e had a chance to palatlize the k. Therefore, G must counterbleed D (must be ordered after it). Second, as stated above, rule G must apply before stress is assigned. Rule E must also apply before stress is assigned, because, for example, the surface form of /klyause+tar/ is stressed on the first syllable, which indicates that it only has two syllables at the time that stress is assigned.

Before complete derivations for the forms of klyaus- and āk- are given, one last problem with the analysis must be solved. The previous analysis of the verb plānt- (pp. 64-65 above) takes the underlying representation of the stem to be /plonto/, but it can be seen now that rule F above would convert this underlying representation into the incorrect surface form plonte-. The problem here is that since underlying /o/ preceding a morpheme boundary is converted into surface e, surface o preceding a morpheme boundary must be derived from some vowel other than /o/. Since every vowel of Tocharian B but one occurs as an underlying vowel also, it would put an end to the shuffling around of the underlying vowels of the system if surface /o/ before a morpheme boundary could be derived from the one surface vowel that does not occur in underlying representations, namely, ā. Thus, the underlying forms of plānt- are as follows, and the new rule which is needed to convert /ā/ before a morpheme boundary to surface o is given as H:

Singular	1	/plontā+mar/	Plural	1	/plontā+mt(t)är/
	2	/plontā+tar/		2	/plontā+tär/
	3	/plontā+tär/		3	/plontā+ntär/

H) $$\begin{bmatrix} V \\ -front \\ -back \\ +low \end{bmatrix} \rightarrow \begin{bmatrix} +back \\ -low \end{bmatrix} \; / \; \_\_\_ \; +$$

Rule H must counterfeed F, because the output vowel of H, o, must not be input to F, or else it would be converted into e, and underlying /ā/ would surface as e, which is incorrect. Thus, H must be ordered after G.

The complete derivations of the forms of klyaus- and āk- can now be given:

	Singular 1	2	3
RULE	/klyauso+mar/	/klyause+tar/	/klyause+tär/
D		klyause+tar	klyause+tär
E		klyaus+tar	klyaus+tär
F	klyause+mar		
G			
H			
B			
	klyausemar	klyaustar	klyaustär

	Plural 1	2	3
	/klyauso+mt(t)är/	/klyause+tär/	/klyauso+ntär/
RULE			
D		klyause+tär	
E		klyaus+tär	
F	klyause+mt(t)är		klyause+ntär
G			
H			
B			
	klyausemt(t)är	klyaustär	klyausentär

	Singular 1	2	3
	/ako+au/	/ake+t/	/ake+än/
RULE			
D		aśe+t	aśe+än
E		aś+t	aś+än
F	ake+au		
G	ak+au		
H	āk+au	āś+t	āś+än
B			āś+ą̈n
	ākau	āśt	āśäm

	Plural 1	2	3
	/ako+em/	/ake+cer/	/ako+en/
RULE			
D		aśe+cer	
E		aś+cer	
F	ake+em		ake+en
G	ak+em		ak+en
H		āś+cer	āk+en
B			āk+ęm
	akem	āścer	ākęm

Given the analysis to this point, certain forms which have not been considered yet in the paradigms of the palatalizing verbs present potential problems; specifically, the following forms require comment (Krause 1952:209):

Active Participle klyauṣeñca

Deponent-Passive Participle klyausemane

Several points need to be made concerning these forms. First, the segmentation of these forms into morphemes should be carefully observed. The e in the active participle must be part of the ending, even though the stem shows palatalization in this form. This segmentation is required because if this e were part of the stem underlyingly, it would derive from underlying /o/, and therefore would not cause palatalization. Thus, this e must be part of the ending, and the palatalization of the stem is caused by underlying /e/ in the stem, which is deleted via rule E. The underlying form of the active participle, therefore, is:

/klyause-eñca/

In the deponent-passive participle, on the other hand, the e that appears on the surface must derive from underlying /o/, just as other surface occurences of e which are not associated with palatalization derive from underlying stem final /o/. Therefore, the underlying representation of this form is:

/klyauso-mane/

The crucial point that must be made concerning the participial forms is that both forms exhibit surface e in the second syllable, but this e must be analyzed in two very different ways in the two forms. Moreover, the treatment of this vowel in each case is dictated entirely by whether or not the vowel is associated with palatalization of the verb stem.

2.2. The Argument against Generative Theory: Palatalizing Causatives.

The generative analysis of the data from Tocharian B is now complete, and it appears that the generative analysis is able to account for the Tocharian forms, except for a weakening of principle 3 that is required by alternations in the palatalizing verbs. There are, however, other forms in Tocharian B which the generative framework cannot give a satisfactory account of. Specifically, it is argued that these forms provide evidence that a correct account of the palatalizing verbs, which are analyzed above phonologically, is not a phonological account at all, but rather, a morphological one. It is further argued that these forms provide evidence against generative phonological accounts in general. In this section, this new evidence is presented, and the arguments against generative phonology which are based on this evidence are given.

The causative forms of some verbs in Tocharian exhibit palatalizations very similar to those already observed above in the (non-causative) forms of verbs like āk- and klyaus-. Specifically, some verbal stems with initial k- have causative forms with initial ś-, and certain stems with initial s- have causative forms with initial ṣ- (Krause 1952:217-309):

kätk- 'überschreiten'
Present Causative Stem śatk- (e.g., participle, śatkässeñca)
Preterite Causative Stem śātk- (e.g., 2nd sg. deponent-passive śātkatai)

kärs- 'wissen'
Present Causative Stem śars- (e.g., 3rd sg. śarsäṣṣäṃ)
Preterite Causative Stem śārs- (e.g., 3rd sg. śārsa)

käl- 'führen, bringen'
Present Causative Stem No forms attested
Preterite Causative Stem śāl- (e.g., 1st sg. deponent-passive śālamai)

kau- 'toten'
Present Causative Stem No forms attested
Preterite Causative Stem śau (e.g., 1st sg. śauwwa)

säl- 'springen'
Present Causative Stem sal- (e.g., deponent-passive participle saläskemane)
Preterite Causative Stem sāl- (e.g., 3rd pl. salāre)

spārtt- 'sich drehen'
Present Causative Stem spartt- (e.g., 3rd sg. sparttassäm)
Preterite Causative Stem spyart- (e.g., 3rd sg. spyārta)

späṇt- 'vertrauen'
Present Causative Stem spant- (e.g., gerundive spantäsälona)
Preterite Causative Stem No forms attested

spärk- 'vergehen'
Present Causative Stem spark- (e.g., 3rd sg. sparkässäm)
Preterite Causative Stem spyark- (e.g., 2nd sg. deponent-passive spyarkatai)

The alternations in these forms are similar to the previously observed ones in that k alternates with ś and s alternates with ṣ; however, they are very dissimilar in that there is apparently no way to analyze the palatalizations in the causative forms as being phonologically conditioned. In particular, the analysis of the non-causative alternations, as in āk- and klyaus- where underlying /e/ before a morpheme boundary causes palatalization and is then deleted, cannot be extended to the causative alternations. The reason that the previous analysis cannot be extended to the causative cases is that these alternations do not take place before a morpheme boundary, at the end of a stem, but rather, at the beginning of a stem, with no following morpheme boundary. Therefore, if /e/ appeared in the underlying representations of the causative forms of the above verbs, there would be no way to delete this vowel by using the rules that have already been formulated. For example, if the underlying representation of the present causative of kätk- were (keätk-/, the underlying /e/ would correctly palatalize the initial /k/ of the stem to ś, but there would then be no way to delete the e using the rules developed thus far, because it does not occur before a morpheme boundary; therefore, the e would incorrectly surface giving *śeätk- (or, if stressed, *śeatk-). Thus, the previous analysis cannot account for the causative alternations, and clearly, these alternations must be accounted for.

The most natural way to account for the causative forms is to revise the previous analysis; however, there does not seem to be any way to revise the analysis in order to account for these forms without creating irresolvable problems at the same time. If the causative stems have underlying /e/, as suggested above, and the e deletion rule is generalized so that it deletes every occurence of underlying /e/, then the palatalizations in the causative forms are correctly predicted, and the underlying e vowels that condition these palatalizations correctly fail to appear in the surface forms. However, such a generalization of the e deletion rule has extremely undesirable consequences; specifically, other parts of the original analysis must also be revised in such a way that the strong form of principle 4 must be abandoned. In the original analysis, surface occurrences of e that are not involved in alternations are derived from underlying /e/, but with

the newly revised e deletion rule, this line of derivation for nonalternating e will no longer be possible, because now, all occurrences of underlying e are deleted. Therefore, all occurrences of surface e must now be derived from some vowel other than underlying /e/. Since some occurrences of surface e derived from underlying /o/ in the original analysis (by rule F), it seems simplest to now derive all occurrences of surface e from underlying /o/, which could be accomplished by removing the morpheme boundary from rule F. This move, however, means that surface occurrences of o that do not alternate, which were originally derived from /o/, must now be derived from some other underlying vowel, since all occurrences of underlying /o/ will now be converted to surface e. Since some occurrences of surface o derived from underlying /ā/ in the original analysis via rule H, this rule can now be generalized by removing the morpheme boundary, so that all surface occurrences of o, whether they are involved in alternations or not, are now derived from underlying /ā/. Thus, generalizing the e deletion rule requires that the o → e and a → o rules be generalized also, so that every occurrence of three different underlying vowels in Tocharian B now surfaces in a form different from its underlying form, which seriously violates principle 4 above. Of course, as previously argued, it would be desirable to hold to as strong a form of this principle as possible, but generalizing these three rules does not seem to allow holding to this principle in any form. What is clearly worse, though, than the necessity of abandoning principle 4 is the fact that the generalized form of the e deletion rule results in Tocharian B having an underlying segment which never surfaces in any segmental form. It leaves behind traces of its presence in underlying representation, by causing palatalization, but the segment itself never surfaces. Allowing languages to have segments in their underlying inventories that never actually surface considerably enlarges the class of the possible phonologies of human languages, and therefore ought not to be allowed if possible.

Beyond the general theoretical problems involved in trying to generalize rules E, F, and H, there are reasons internal to Tocharian for rejecting this move as a possible way of accounting for the palatalized causative forms. For these same reasons, it can be argued that no phonological account of these forms is possible. In particular, the first consonant of the stem appears in exactly analogous phonological environments in both the causative forms, where the consonant is palatalized, and in the noncausative forms, where the consonant is not palatalized. For example, the k in the non-causative forms of the verb kau- (p. 74 above) appears word-initially before the dipthong au, and the ś in the preterite causative stem appears in exactly the same environment. Similarly, the s in the non-causative forms of the verb spant- (p. 75 above) appears in exactly the same environment as the ṣ in the present causative stem. Presumably, in generative theory, the non-causative and causative forms of these verb morphemes should be the same underlyingly, since they are the same morpheme. Therefore, it follows that there could be no phonological difference between the underlying representations of the causative and the non-causative forms that could cause the difference between the palatal and nonpalatal consonants in the stem.

Using a line of reasoning employed by Halle (1959:21-23) to argue against classical phonemics as a correct theory of phonology, the Tocharian facts provide an analogous argument against generative phonology as a correct theory of phonology. Halle argued that, since some voiced obstruents

in Russian are allophones, while others must be considered phonemes, that two different obstruent voicing rules would be required by classical phonemics in order to account for the fact that in Russian all obstruents are voiced before a voiced obstruent. In effect, as Halle sees it, one obstruent voicing rule would be required to get from the morphophonemic to the phonemic level, which would operate only on those voiceless obstruents whose cognate voiced obstruents have the status of phonemes in Russian, and another obstruent voicing rule would be required to get from the phonemic to the phonetic level, and this rule would operate only on those voiceless obstruents whose cognate voiced obstruents have the status of allophones in Russian. However, Halle aruges, this treatment breaks the obstruents up into two classes and requires an "extra" obstruent voicing rule, when there really should only be one voicing rule, since, whether the rule operates to derive segments that have the status of phonemes or the status of allophones, it achieves exactly the same effect, namely, making obstruents voiced before voiced obstruents. Halle concludes that if the "bi-uniqueness condition", and therefore also the phonemic level of representation, is dropped, then Russian obstruent voicing can be covered by a single general rule.

Accepting Halle's reasoning for the moment without argument, an analogous case can be constructed against generative phonology, using the Tocharian facts, as follows. In Tocharian, k alternates with ś, and s alternates with ṣ. Some of the instances of each of these two alternations can be accounted for within a generative framework by a phonological rule; however, other instances of these alternations (in the palatalizing causatives) cannot be accounted for by that same phonological rule. Therefore, a generative account of Tocharian must treat the instances of a single phenomenon in two different ways (however it is that the palatalizing causatives are handled, it has already been shown that it cannot be phonologically, and therefore, they must be treated differently than the palatalizing present verbs), and therefore misses a generalization about Tocharian.

A possible counterargument to the argument that a generative account must miss a generalization here would be simply to claim that there is no generalization to be caputured here; that is, to claim that the instances of k,s alternating with ś,ṣ in the palatalizing causatives and the instances of these alternations in the palatalizing presents are not really the same phenomenon, and therefore need not be accounted for in a single way. There are several reasons why this counterargument is not satisfactory, however. First, each of the instances of k alternating with ś and s alternating with ṣ involves exactly the same two segments, not just the same two classes of segments, as in Russian, where all the alternations involved in the argument are cases of voiceless obstruents alternating with voiced ones. Thus, though it might be said that it is somehow counter-intuitive to claim that all of the cases of the k~ś and s~ṣ alternations involve the same phenomenon, it seems rather that it would be counter-intuitive to claim that they are not. Further, in Tocharian, ś alternates only with k;[16] and ṣ alternates only with s. Thus it seems strange intuitively to claim that these alternations are not all one phenomenon.

Since intuition seems to weigh in the favor of the argument against generative phonology, a more principled objection to the argument might be sought. In particular, it might be objected that although the substitutions of ś for k and ṣ for s involve the same segments, the substitutions have different causes. Specifically, the substitutions of ś for k and

ś for s in the palatalizing presents like āk- and klyaus- seem to have clearly phonetic teleologies; that is, ś and ś being substituted for k and s before the palatal vowel e (this also happens before ī in Tocharian) is clearly phonetically motivated. On the other hand, these same substitutions occurring in the palatalizing causatives apparently have no such phonetic motivation. Thus, the two sets of substitutions really do appear to have different causes; therefore, they could be claimed to be instances of different phenomena, and the fact that a generative analysis must account for them in two different ways is no longer a problem, and is in fact to be expected. However, such an argument is inconsistent with the generative point of view, for in generative theory, multiple causes for a given substitution are never seen as a reason to treat that substitution as several different phenomena. On the contrary, in such a case, all of the different causes for the substitution would be grouped together (using curly brackets), and treated as instances of the same rule. For example, the two rules

$$a \rightarrow b \;/\; \_\_\_\; x$$
$$a \rightarrow b \;/\; \_\_\_\; y$$

would be collapsed as

$$a \rightarrow b \;/\; \_\_\_\; \begin{Bmatrix} x \\ y \end{Bmatrix}$$

The fact that x causes the substitution of b for a in one case, and that y causes it in the other case is virtually irrelevant in generative theory. The two rules are formally similar in a way that makes them collapsible within the theory; therefore, they are to be collapsed. The difference in the causes of the substitution in individual cases is not relevant in generative theory; likewise, then, the different causes of the k~ś and s~ś substitutions in Tocharian cannot be used to justify the claim that there is more than one phenomenon. Thus it has been demonstrated, using criteria entirely internal to generative theory itself (Halle's argument from Russian and the criterion of combining formally similar rules), that generative theory cannot provide a correct account of the k~ś and s~ś alternations in Tocharian.[17]

2.3. On the Ad Hoc Nature of Generative Phonological Analysis.

It might be suggested that there really is a generative account for the palatal alternations in Tocharian, despite the fact that the alternations in the present can be accounted for phonologically, while the alternations in the causative are not phonologically conditioned. This account would consist of collapsing the two rules which would be needed to account for both of the two types of palatal alternations, in the present palatalizing verbs and in the palatalizing causatives, into a single rule. In other words, rules I and J below could be collapsed into rule K:

$$\text{I)} \left\{ \begin{bmatrix} -\text{vocalic} \\ +\text{back} \end{bmatrix} \rightarrow \begin{bmatrix} -\text{back} \\ +\text{continuant} \end{bmatrix} \right\} \;/\; \_\_\_\; e+$$
$$\left\{ \begin{bmatrix} +\text{anterior} \\ +\text{continuant} \end{bmatrix} \rightarrow \begin{bmatrix} -\text{anterior} \\ +\text{high} \end{bmatrix} \right\}$$

J) { [-vocalic, +back] → [-back, +continuant] ; [+anterior, +continuant] → [-anterior, +high] } / # ___ +causative

K) { [-vocalic, +back] → [-back, +continuant] ; [+anterior, +continuant] → [-anterior, +high] } / { ___ e+ ; # ___ +causative }

Such a move is possible because there is no distinction in generative phonology between rules that involve phonological conditioning of alternations , such as rule I, and rules that do not, such as rule J.[18] That is to say, there is no reason in generative theory why two rules such as I and J cannot be collapsed using the curly brackets notation. Collapsing these two rules seems to get around the argument given in the last section that generative phonology cannot give a unified account of the palatal alternations in Tocharian, even though the criteria of the theory itself demand that a unified account be given. At the same time, however, collapsing rules I and J does not correctly account for all of the facts about the palatal alternations in Tocharian. In particular, there are verbs that have stems with initial k and s that do not palatalize in the causative (Krause 1952:217-309):

kātk- 'sich freuen'
Present Causative Stem kātk- (e.g., participle kātkässeñca)

kārp- 'herabsteigen'
Present Causative Stem kārp- (e.g., 2nd deponent-passive kārpasträ)
Preterite Causative Stem kārp- (e.g., 2nd sg. karpässasta)

kän- 'zustandekommen'
Present Causative Stem kan- (e.g., participle kanseñca)

kärn- 'schlagen'
Present Causative Stem kärn- (e.g., participle karnnässeñca)

kälp- 'erlangen'
Present Causative Stem kalp- (e.g., 1st sg. kalpäskau)

kery- 'lachen'
Present Causative Stem ker- (e.g., 2nd pl. kerästrä)

krās- 'verdriessen'
Present Causative Stem krās- (e.g., 3rd sg. krāsässäm)

sāk- 'zurückbleiben'
Present Causative Stem sāk- (e.g., 3rd sg. sākässäm)

sätk- 'sich ausbreiten'
Preterite Causative Stem sätk- (e.g., 1st sg. deponent-passive sätkasamai)

soy- 'satt werden'
Present Causative Stem soy- (e.g., 3rd sg. soyäṣṣäm)
Preterite Causative Stem soy- (e.g., 1st sg. soyäṣṣāwa)

staukk- 'müde werden'
Present Causative Stem staukk- (e.g., 3rd sg. staukkäṣṣäm)

swār- 'gefallen'
Present Causative Stem swār- (e.g., 2nd pl. swārästrä)
Preterite Causative Stem swār- (e.g., 2nd pl. deponent-passive swāräṣṣat)

The above forms clearly require a revision in rule J (and therefore in rule K), because, as it stands, this rule predicts that all verbs in Tocharian with initial k and s will have the corresponding palatal in the causative, but the above forms do not. Thus, beyond the fact that the k~ś and s~ṣ alternations in the causatives cannot be phonologically predicted, and must therefore be accounted for by a rule that mentions the nonphonological category causative, this rule must also be lexically restricted; i.e., it applies to some lexical items, but not to others. This lexical restriction is necessary because there is no other way, phonological or otherwise, to distinguish the causatives with palatalization of the initial consonant from those without palatalization. If the rule is restricted in this way, then rule K seems to correctly account for the palatal alternations in Tocharian.

Though it now appears that a generative account of all of the palatal alternations in Tocharian can be given, it must be pointed out that the devices which are needed for this account are extremely powerful; in fact, it can be argued that all of these devices together yield a phonological framework which is generatively omnipotent, and which allows for, in fact, necessitates, totally ad hoc analyses. If the methodology that is used in analyzing the Tocharian data is examined, the ad hoc nature of the analysis can be seen cearly; further, it can be seen why the four principles of generative phonology given above (pp.58-9) do not really constitute any significant restrictions on, or predictions about, the phonologies of human languages.

First, in the analysis of the present palatalizing verbs (pp. 66-72), it is found that the alternations in these verbs cannot be accounted for by phonological means alone, but that, if the vowel at the end of the stem is underlyingly /o/ in the 1st person singular and in the 1st and 3rd persons plural, and /e/ in the other persons, then the alternations can be accounted for by phonological means. However, as noted before, this move means that the present palatalizing verbs like klyaus- and āk- cannot have a single underlying representation. Thus, just on the basis of the analysis of the present palatalizing verbs, it can be seen that principles 2 and 3 (pp.58-9) are not absolute restrictions. Phonological rules that mention only phonological information and single underlying representations for every morpheme in the language are preferred, but generative thoery makes no guarantees that these preferences will not have to be violated in some cases. Preferences guide an analyst in choosing from among a number of different possible analyses, but clearly they have

no value in making a theory more restrictive, for, though one type of language or another is preferred, the theory stills does not predict that the other types cannot exist. If the possibility of restricting phonological rules lexically, as is necessary if a generative account of the causative palatalizations is to be given, is considered, it can be seen how totally ad hoc analyses are possible. In the Tocharian case, as in all cases, a phonological account is considered first, but if none is available, the theory is still not disconfirmed, because morphological categories or other nonphonological information may still be used. This move of resorting to nonphological information is the step that seems required for the Tocharian causatives; in other words, once a rule that mentions the category causative is formulated, the forms seem to be accounted for. However, when it is found that there are other forms that the rule does not account for, and further, that now lexical restrictions must be placed on the rule, the theory is still not disconfirmed. Of course, a lexical account cannot fail, because the forms that the rule should apply to, it is allowed to apply to, and the forms that it should not apply to are simply excluded from its application. If a phonological theory is allowed to condition phonological rules lexically, then it cannot be disconfirmed, but if generative theory is prevented from conditioning phonological rules lexically, then it is disconfirmed by the case of the Tocharian causative forms, because it cannot account for them in any other way.

The reason then, that generative analyses are necessarily ad hoc is that the analysis can always be tailored to fit the facts at hand. A restrictive theory of phonology, by contrast, would predict that certain facts will never be encountered, and would be falsified if such facts should be discovered in some language. In the next chapter, a proposal is outlined that would constitute a restrictive theory of phonology, which at the same time requires the formulation of a theory of morphology, which, it is argued, can also be restricted in significant ways.

3. A Morphological Account of the Tocharian Palatal Alternations.

3.1. Separating Phonology and Morphology.

It can be argued that one of the primary reasons that generative phonology is such a nonrestrictive theory is that it fails to make any distinction between purely phonological rules, that is, rules that contain only phonetic information, and morphological rules, that is, rules that may mention morphological categories and boundaries. When phonological rules are allowed to be morphologically or lexically conditioned, they are very powerful devices, and if no explicit restrictions are placed on them otherwise, they can potentially generate virtually any phonological output from any given input. However, if phonological rules are restricted so that they contain only phonetic information, that is, segmental features, and phonological boundaries, i.e., syllable, word, and phrase boundaries, then their output is considerably more restricted. Further, in a theory of phonology where the possible phonological substitutions are limited, such as in the theory proposed by Stampe (1979), the generative power of the theory is yet more restricted. Theories of phonology in this sense of phonology, however, since they deal only with phonetically conditioned substitutions, could not account for alternations of the type found in the Tocharian palatals. Since these substitutions are morphologically conditioned in some way, a device separate from phonological rules needs to be developed to account for them, and further,

in keeping with the goal of linguistic theory, it must be shown how this device can be restricted so that it excludes certain language types and therefore has empirically testable consequences.

3.1. An Account of the Tocharian Palatals.

The device that is used to account for the palatals in Tocharian must correctly predict in what places they occur, and it must account for which stems exhibit the alternations, and which do not. In order to do this, the proposal being made here utilizes a particular way of listing morphemes in the lexicon, along with a rule that distributes the allomorphs of each morpheme. The lexical entries required would be the following:

klyaus/ṣ : 'hören'

ak/ś : 'führen'

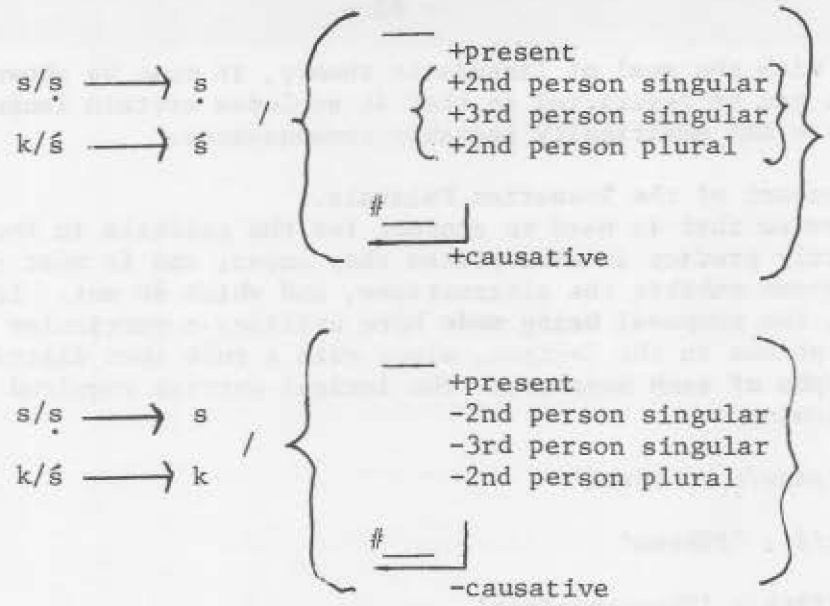
k/śätk : 'überschreiten'

s/ṣäl : 'springen'

katk : 'sich freuen'

sak : 'zurückbleiben'

The slash line is to be interpreted as meaning that the segment at that location in the morpheme can be any one of the segments given on either side of the slash line. This device seems to capture what speakers actually know, since for a given morpheme, speakers must know whether the morpheme has allomorphs, and if so, what those allomorphs are. Morphemes such as katk and sak are identified as nonalternating becuase they have only a single allomorph listed in the lexicon. The reason for not listing only one allomorph in the lexicon for morphemes that do alternate, and treating the other allomorphs as derived by rule, is that the choice of which allomorph is derived and which allomorph is lexical would be entirely arbitrary. Until some principled basis for treating one or the other of the allomorphs as derived can be found, it seems justified to list all of the allomorphs in the lexicon. A rule to distribute the allomorphs of the alternating morphemes would be required also, formulated as follows:



These rules, along with the lexical entries above, correctly account for which morphemes in Tocharian exhibit palatal alternations and which do not, and also correctly accounts for where the palatal segments occur, and where the nonpalatal segments occur. Now, though, it must be shown how these devices make predictions about possible language types. In order to do this, however, the phonemes of the language must be determined. The meaning of phoneme intended here is that of Stampe (1979). The restriction then, on the type of morphological rule proposed above is that the output of such a rule will always be a phoneme of the language, as determined by the phonology of the language. Further, the segments involved in alternations which can be accounted for by these rues will always occur in some positions in the lexicon where they do not alternate. As can be seen, this restriction holds in Tocharian; that is, the above rules account for a morphological alternation between k, s and ś, ṣ in Tocharian, and k and s occur in morphemes in other places in the lexicon where they do not alternate, for example, in kātk- and sāk- (p. 82). ś and ṣ also occur nonalternating in Tocharian, for example, in śāmp- 'übermütig sein', and ṣäms- 'zahlen', where the ś and ṣ in the two stems do not alternate with any other segments.

The restriction proposed above for the type of morphological rule given on pages 82-83 constitutes an empirical hypothesis about human languages; therefore, this proposal is empirically falsifiable. Further, the sort of case that would falsify this proposal is clear. If a morphological rule were to produce a segment which did not occur as a nonalternating segment anywhere in the lexicon, then the rule would be a counterexample to the proposal. Therefore, this proposal is testable in a way that the principles of generative phonology are not. Further, since the output of these morphological rules is always a phoneme of the language, the final output of all the morphological rules, which all apply before any phonological rules, will always be in terms of exactly the same segments that occur in the lexicon. Thus, the morphological component cannot "create" any new segments; it is severely restricted. Further, this restriction is a significant one, because it limits the generative power of morphological rules individually and of the morphological

component as a whole. Further, as a result of the fact that the types of morphological rules proposed above manipulate only (classical) phonemes of the language, it follows that speakers are aware of the alternations in morphemes which are accounted for by morphological rules (since these rules substitute phonemes for other phonemes), and that they are never aware of alternations in morphemes which are due to phonological rules (in the narrow sense of phonology referred to above). This fact has some interesting empirical consequences. The most important of these consequences is that alternations due to morphology are subject to analogy, but alternations due to phonology are not. Thus, it is predicted that when clear cases of analogy are found, they will always be cases of speakers simplifying, extending, or reanalyzing alternations due to morphology. Again, this constitutes a further empirical prediction about human languages, because of analogies on phonological alternations were found, the prediction would be falsified.

4. Conclusion.

The sort of account that the Tocharian palatal alternations force a generative theory to give shows particularly vividly the ad hoc nature of generative analyses. Specifically, the nature of the Tocharian data forces a generative approach to abandon the attempt to provide a strictly phonological account and to retreat further and further from the position that all alternations can be accounted for using strictly phonological information. The Tocharian facts drive the generative analysis eventually all the way to the extreme position that phonological rules may be lexically restricted. Certainly, however, it must be concluded that if the theory is forced to allow phonological rules to be morphologically and lexically conditioned, then there is no value in intractably maintaining the position that all alternations can be accounted for by "phonological" means. As is suggested above, once the need for reference to morphological information in order to account for at least some alternations is conceded, then it seems reasonable to propose that morphology and phonology are in fact separate components of grammar, and that, in such a theory, phonological rules are not sensitive to any nonphonetic information. Such a restriction on phonological rules is a significant one, and as proposed above, a separation between phonological and morphological rules also allows restrictions on the morphological component of grammar. However, even if this restriction on morphological rules turns out to be incorrect, this fact would not lessen the validity of the arguments given here against generative phonology as a correct theory of the phonologies of human languages.

Notes

[1]For other expressions of this view, see Chomsky 1965:6, 27; Chomsky and Halle 1968:4; Wall 1972:295-296.

[2]Actually, generative phonologists did not originally hold to the position expressed by this principle, but rather, to another position known as the "free ride" principle, also stated by Zwicky (1972:158):

> "Choose the representation that results in the longest derivations."

Principle 4 is included here because it is a significant attempt to limit the possible phonologies of human languages. In fact, Zwicky (1972:158) gives this principle as one of two conditions imposed by Kiparsky (ms. 1968;1971) on abstract phonological analyses.

[3]Krause and Thomas do not give the inventory of sounds in the form of a chart, but this format is used here for clarity.

[4]Krause and Thomas (1960:39) call this sound "palatalisiertes s," but give no further description. It seems reasonable to interpret this sound as something in the area of a palatoalveolar, but whether this interpretation is exactly correct or not, it makes no crucial difference for the arguments given here.

[5]The gloss provided for this form, and for all subsequent forms, is taken directly from the work cited as the source of the form.

[6]The absence of w in kulypelle and kursarwa is apparently due to the fact that w is never written before u in Tocharian B.

[7]The best evidence for the placement of stress in Tocharian B is the alternation that occurs between a ~ ä and ā ~ a discussed above in section 1.1 (Krause and Thomas 1960:43; Krause 1952:10 ff.).

[8]The citation form used to refer to a given verb is taken from Krause and Thomas (1960) or Krause (1952), and is not meant to imply anything about the underlying representation of the verb. Unless otherwise noted, the paradigms of all verbs given here can be found in Krause and Thomas (1960).

[9]Krause and Thomas actually give this form as pälkem(o). Krause (1952:7-8) says, concerning the final o that sometimes occurs:

> "Ein bewegliches -o findet sich häufig -und nach Bedarf des Metrums- in poetischen Texten im absoluten Auslaut da, wo im Indogermanischen ein (später apokopierter) Vokal vorhanden war."

Therefore, since the form with final -o occurs only in poetic texts, under the influence of the meter, the form without final -o is here taken to be the normal one.

[10]For the phonological feature system used here, see Chomsky and Halle (1968). One feature has been added to the system found there for the purposes of the analysis given here. Specifically, Chomsky and Halle have no way to differentiate central vowels unambiguously from all other vowels. Thus, the feature front is used here for this purpose.

[11]Zwicky (1972:154) states that "distributional restrictions on phonological elements" are generally taken to be among the "data to be comprehended by a phonological analysis." Thus, phonologists typically assume that segments that have a limited distribution are derived rather than underlying; that is, if a surface segment occurs only in restricted contexts, it is generally assumed that the distribution of that segment is to be accounted for phonologically, and not lexically. From this it follows that, in "orthodox" phonology, the occurrence of a given segment in underlying representation should be unrestricted (except, of course, for the sorts of restrictions that are handled by morpheme structure constraints). Thus, possible restrictions like those discussed above on the underlying occurrence of ä and ā would usually be seen as unnatural, and therefore, a solution which results in such restrictions is to be avoided if possible.

[12]trik- is given here to demonstrate that the deletion analysis is not possible, because it might be claimed that the difference between a verb like mäsk-, where the e always surfaces, and a verb like klyaus-, where the e sometimes does not surface, is that the e is preceded by two consonants in mäsk-, but only by one in klyaus-. A verb like trik-, where a single consonant precedes the e, yet where the e always surfaces, shows that the difference between one and two consonants preceding the e is irrelevant to whether the vowel is retained or deleted.

[13]This form also has final -o in poetic texts.

[14]Again, this form shows final -o in poetic texts, and is stressed on the second syllable, which explains the a in the first syllable, in contrast to ā in the other forms.

[15]In addition to rośicer and täṣītär, there are a large number of other cases of medial ī and i causing palatalization but also being retained (Krause 1952:217-309):

aiśimar imperfect of aik- 'wissen, erkennen'
ausimar imperfect of auk- 'aufwachsen, zunehmen'
kraṣīyate durative of krās- 'verdriessen'
klyausiyem imperfect of klyaus- 'hören'
näśītar optative of näk- 'vernichten'
paṣṣīmar imperfect and optative of pāsk- 'hüten'
prekṣītär imperfect of prek- 'fragen'
trisimar causative optative of trik- 'in die Irre gehen'

[16] ś also alternates with s, but this is always following another s, e.g., paṣṣīmar, imperfect (and optative) of pāsk- 'hüten,' with -ṣṣ- from -sk- before ī. This, of course, does not bear on the issue at hand, because ś usually alternates only with k, and ṣ with s.

[17] David Stampe (1979:79, note 17) has also shown that Halle's argument applies to generative theory itself, but Stampe's argument is different than the one given here. Stampe has also argued (personal communication) that Halle's argument against classical phonemics is valid only if a "level" of representation is conceived of as a "natural break in a linear ordered set of 'rules'," but no one has apparently ever argued that this conception of a level of phonological representation is a correct one. Until this view has been established, Halle's argument against classical phonemics cannot be considered valid. On the other hand, the argument given above in this thesis does not depend on this conception of a level, and therefore is valid regardless of whether Halle's view of phonological representation is correct or not.

[18] Of course, as principle 2 above (p.58) states, rules with only phonological conditioning are preferred, but that does not mean that rules such as J are not permitted, only that they are to be avoided if possible. In this case, the data demands that a rule such as J be formulated.

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